



Jejunal Anastomosis using Sero-submucosal Suture Patterns in Donkeys

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General Note



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ABSTRACT

Experimental study was conducted to compare and evaluate between two anastomosis techniques for jejunaum in donkeys. Aim of the present study was to test the efficiency in term of time required to complete anastomosis, stenosis in lumen, changes in wall thickness, also adhesion formations at anastomatic site. Twelve apparently healthy donkeys were used. Animals divided into two groups. Two rows serosubmucosal continuous Lambert suture (SSCLS) patterns were performed in first group while second group underwent one row serosubmucosal interrupted suture (SSIS) pattern. Ultrasonographic scanning was performed at day 0, 15th and 30th for determination changes in lumen and wall thickness. Gross pathological changes were observed to determine adhesion. Time required in SSIS was significantly shorter ($P \leq 0.05$) compared to SSCLS. Ultrasound revealed no significant differences in lumen in both groups, however, a significant decrease in wall thickness on day 15 post surgery observed in SSCLS, although severe adhesion

(40%) observed at anastomatic site in SSIS. It is concluded that both techniques were effective, safe, and reliable and can be used in donkeys, however, SSCLS was found to be superior to SSIS.

Keywords: Donkeys, Anastomosis, Suture Patterns, Ultrasound.

1. INTRODUCTION

The small intestine of the donkeys is subject to obstruction from a variety of causes, in most cases, obstruction results in vascular occlusion which leads rapidly to irreversible tissue changes in the obstructed segment of the intestine. Unless the donkey is referred for surgery very early in the course of the condition, resection of the compromised intestine is usually imperative. Resection and end to end anastomosis of small intestine are one of the common surgical techniques encountered in routine and emergency cases. There are various techniques among anastomosis of the resected intestinal segments (Pathak *et al.*, 2014). The anastomosis may be performed by end to end, end to side and side to side by a single layer or double layers suture techniques. There have been numerous clinical and experimental studies were done on surgical techniques followed by healing processes for the intestinal anastomosis (Ballantyne, 1984; Halsted, 1887). Several recent reports have advocated use of single layer method for intestinal anastomosis with advantage of shorter time required, lower cost and lower complication of anastomotic leakage (Pathak *et al.*, 2014). This study was conducted in donkeys to evaluate the efficacy of two layers sero-submucosal continuous lambert suture (SSCLS) pattern and one layer sero-submucosal interrupted suture (SSIS) pattern in term of the time that required to complete suture patterns in each group, jejunal lumen diameter, jejunal wall layers thickness and adhesion formation throughout four weeks post surgery.

2. MATERIALS AND METHODS

Study area

The present experimental study was carried out in Veterinary Teaching Hospital, at Faculty of Veterinary Medicine, Al-Butana University.

Experimental animals

A total number of twelve clinically sound donkeys (3 females and 9 males) of different local breeds, 7 ± 4.1 years of age, and weighing 93 ± 7.8 kg were used.

Management and control

Animals were housed under similar conditions, donkeys were dewormed two weeks prior to surgery (Levanide D-S, 500 ml, BashPharm, Sudan), tetanus antitoxin (1500 IU/ML) was administered some days before surgery and antibiotic (Amoxicillin 150 mg, Betamox 150mg, Norbrook, U.K) was injected intramuscularly (7mg/kg) immediately before surgery. Animals were fasted overnight to ensure a safe general anaesthesia and facilitate bowel manipulation, while free access to water was allowed.

Surgical procedure

A left flank incision laparotomy approach using Ketamine hydrochloride (6mg/kg) I.V. as a sole anaesthetic, xylazine (2 mg/kg) as premedication. Haemorrhage was arrested, the jejunum was exteriorized, and the sites for resection and anastomosis were approximately 15 ± 2 cm long with the same diameter. The jejunal segments were resected after mesenteric blood vessels ligation. Ingesta were manually stripped from anastomotic sites into the rectum. The lumen of the bowel was temporarily occluded with non-crushing intestinal forceps to prevent return of ingesta to the anastomotic site. End-to-end anastomosis using 2-0 polyglycolic acid (Surgicryl PGA; Ethicon, UK) with two rows sero-submucosal continuous lambert suture (SSCLS) patterns was performed in the first group (SSCLS group) to anastomose the resected segments of intestine, while one row sero-submucosal interrupted suture (SSIS) pattern was used in the second group (SSIS group). After the anastomosis, the jejunum was returned to its normal place after being washed with physiological saline (0.9% NaCl). Peritoneum and muscular rows were sutured using simple continuous pattern and the skin was closed using simple interrupted suture pattern.

Study description

The first group was anastomized using two row serosubmucosal continuous lambert suture (SSCLS), the second group was connected by using one row serosubmucosal interrupted suture (SSIS).

Time Required

The time required for the anastomosis was calculated from the beginning the first stitch bites to the end of connection between two resected bowels segments according to (Rahul *et al.*, 2015).

Ultrasonography Evaluation

A left flank laprotomy was performed, the lumen and wall thickness of jejunal segments were measured using ultrasonographic imaging as base line values (day 0), then 15 cm length of the above mentioned bowel were resected and connected by using SSCLS and SSIS suture patterns, then the lumen diameter and bowel wall thickness at the anastomatic site were re-measured on days 15 and 30 following surgery using the same transabdominal ultrasonography techniques (Aloka SSD 500_R, Aloka Co., Ltd, Tokyo, Japan), with probe model UST-660-7.5 (Aloka Co., Ltd). The images were analyzed using digital video for retrospective image computer analysis (figure 1).

Pathological Findings

Gross pathological changes on anastomatic site were observed to detect any intra-abdominal adhesions using a standard scale according to Hulka *et al.*, (1978).

The degrees of adhesion were graded as follows:

0 point= No adhesion

1 point= slight adhesion

2 points= mild adhesion

3 points= Severe adhesion

Statistical Analysis

The collected data was analyzed using Computer program statistical package for social science (SPSS) version 24 was used for data analysis, Student's t-test was used to compare the results and $p \leq 0.05$ was considered to be statistically significant and results were presented as mean \pm standard deviation ($M \pm SD$).

3. RESULTS

Consumption Time

Time required to achieve anastomosis suture patterns (minutes) was recorded. (Table 1) showed that suture patterns using SSIS technique consumed shorter time compare with that time required to complete jejunal anastomosis in donkey by using SSCLS suture patterns.

Table (1): M \pm S.D of consumption time (min) for jejunal anastomosis using two rows sero-submucosal continuous Lambert sutures (SSCLS) and one row sero-submucosal interrupted suture (SSIS) in donkeys.

Techniques	Number of animals	Time (min.)
SSIS group	6	13.67 \pm 3.445 ^a
SSCLS group	6	21.33 \pm 4.55 ^b
Sig		*

n = 12

Sig: Significance

*= Significant at ($P \leq 0.05$)

^{a,b} Mean (\pm SD) in each column with no common superscript are significantly different ($P \leq 0.05$).

Lumen Diameter

lumen diameter was measured using ultrasonography technique (table 2 and Figure 2) prior to surgery (as baseline values) then 15 and 30 days following surgery, there were no significant differences between lumen diameter in both suture patterns, however, slight stenosis was observed on 30th day post surgery in SSCLS group to those obtained SSIS group.

Table (2): M \pm S.D of lumen diameter (cm) for jejunal anastomosis using two rows sero-submucosal continuous Lambert sutures (SSCLS) and one row sero-submucosal interrupted suture(SSIS) at intervals 0, 15, 30 days following surgery in donkeys.

Techniques	Number of animals	0 day	15 days	30 days
SSCLS	6	27.97 \pm 3.91	29.75 \pm 6.30	23.30 \pm 1.84
SSIS	6	27.40 \pm 1.87	27.25 \pm 5.44	29.65 \pm 5.73
Sig		N.S	N.S	N.S

n = 12

0 day: Base line values

Sig: Significance

N.S: Not significant

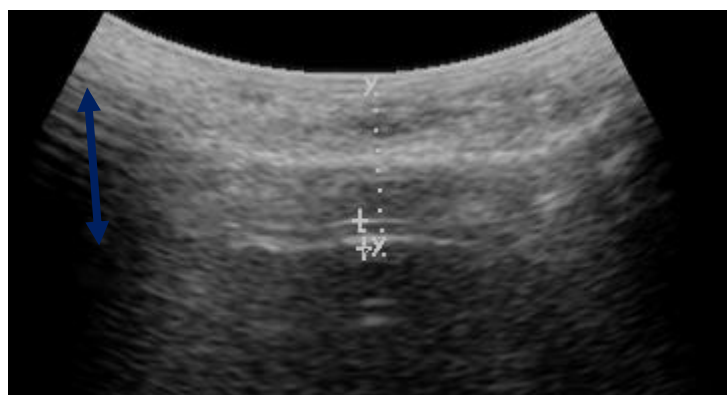


Figure (1): Jejunal lumen diameter (long arrow) and jejunal wall thickness (short arrow)

Jejunal Wall Thickness

Jejunal wall thickness was measured prior to surgery as baseline values (cm) then 15 and 30 days after jejunal anastomosis, using ultrasound imaging. The wall thickness as decreased ($P \leq 0.05$) on day 15 in both groups compared to normal values, however, increasing in wall thickness was observed in SSCLS group on 30th days following surgery (Table 3).

Table(3): M \pm S.D of Jejunal wall thickness (cm) for jejunal anastomosis using two rows sero-submucosal continuous Lambert sutures (SSCLS) and one row sero-submucosal interrupted suture (SSIS) at intervals 0, 15, 30 days following surgery in donkeys.

Techniques	Number of animals	0 day	15 days	30 days
SSCLS	6	4.97 \pm 0.80	2.90 \pm 0.00 ^a	7.25 \pm 1.78 ^a
SSIS	6	4.77 \pm 1.55	3.45 \pm 0.07 ^b	4.95 \pm 0.21 ^b
Sig		N.S	*	*

n = 12

0 day: Base line values

Sig: Significance

*= Significant at ($P \leq 0.05$)

N.S: Not significant

a,b Mean (\pm SD) in each column with no common superscript are significantly different ($P \leq 0.05$).

Degree of Adhesions

The adhesions at the anastomatic site were scored as mild, slight and severe adhesions. Donkeys that anastomized using SSIS suture pattern showed 40% severe and mild adhesions at anastomatic site, while animals that underwent surgery using SSCLS suture pattern showed 40% and 60% mild and slight adhesions respectively (Figure 2 and 3).

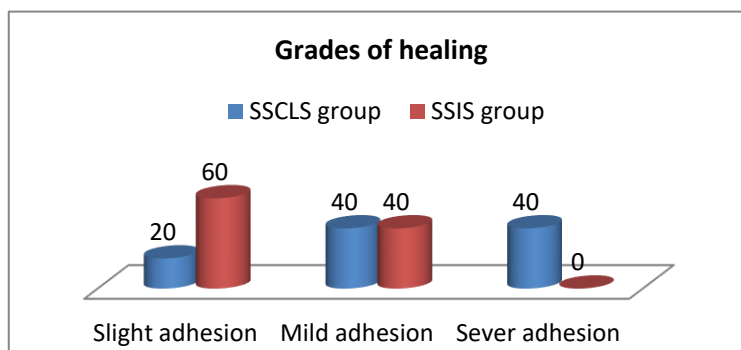


Figure (2): The Adhesions degree (%) for jejunal anastomosis using two rows sero-submucosal continuous Lambert sutures (SSCLS) and one row sero-submucosal interrupted suture (SSIS) in donkeys.

n= 12(6 in each group).

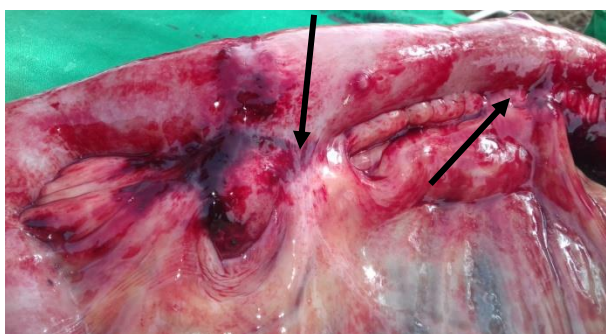


Figure (3): The adhesion formation at anastomotic site (arrows).

4. DISCUSSION

The aim of resection and anastomosis of the small bowel is to remove irreversibly injured, benign or malignant indications. All types of suture patterns and materials were seeking for optimize healing and restore luminal diameter and mural integrity (Pathak *et al.*, 2014).

The mean consumption time which required to complete anastomosis showed shorter time (min) for single row serosubmucosal interrupted suture (SSIS) group, compared with that time required to achieve two rows serosubmucosal Lambert suture pattern (SSCLS) group. These results were strongly supported by finding of other authors such as Burch *et al.* (2000) who reported that a mean of 20.8 minutes was required to construct a single layer anastomosis versus 30.7 minutes for the two-layer technique in duodenum anastomosis in man. Auletta *et al.* (2011) reported that the anastomosis using a continuous Lambert single layer pattern were faster to be performed compare with gambee suture pattern in equine, and Mehmoud *et al.* (2012) also reported that the mean time taken for anastomosis was 18.30 minutes in single layer interrupted extra-mucosal pattern and 25.87 minutes in double layer anastomosis type in man. The mean duration of intestinal anastomosis for the double layer group was 33.06 minutes whereas for the single layer group, it was 23.6 minutes (Rahul *et al.*, 2015; Pathak *et al.*, 2014).

Examining of the jejunal lumen diameter after two suture patterns of anastomosis revealed that slight decreased was occurred on day 30 post surgery in both groups. On the other hand, the jejunal wall thickness reduction was observed in both groups at 15 days post surgery and more wall thickness increased at 30 days post surgery only in SSCLS group. These results were in the same line with Reinertson, (1976), who reported that modified Gambee technique for intestinal anastomosis in equine were resulted near normal lumen diameter, and adequate strength. Lee *et al.*, (2012), who reported that the relative lumen diameters was larger for

single layer compared with two layers. Similarly Dean *et al.* (1985), reported that no significant differences in reduction of lumen diameter between the variations of the two layer technique in horses.

Slight stenosis degree observed during this study is in agreement with other results obtained by Hanson *et al.*, (1998a), Who reported no difference in lumen diameter between the inverting two row suture patterns and appositional two rows suture pattern. While Hamilton (1967) reported that the standard two-layer inverted technique narrowed the intestinal lumen, while the single layer inverted technique caused slight decreased. Al-Qadhi and Al-Hasan (2013) reported degree of stenosis rate was lower in simple interrupted suture technique after 7 days of operation, while the degree of stenosis rate was higher in continuous Lambert suture pattern after 15 days in equine.

In the current study, severe adhesion formations were greater in one row serosubmucosal interrupted suture (SSIS) pattern compared with two row serosubmucosal continuous Lambert suture (SSCLS) patterns. These results were incoordinate with that obtained by other researchers, Al-Qadhi and Al-Hasan (2013) who observed severe adhesions at anastomotic site with omentum in horses, Hanson *et al.*, (1998b), revealed on post-mortem examination, extensive adhesion formations from the mesocolon to the stapled anastomotic site compared with the a simple interrupted suture pattern. Although, Hanson *et al.*, (1998a), reported that adhesions formation detected in horses when resection line was closed with the appositional one row suture pattern. Also Reinertson, (1976), found that double rows inverting technique predisposed to intestinal obstruction was resulted in minimal adhesions in both horses and ponies. Al-Timmemi *et al.* (2010) mentioned that one row of sero-submucosal interrupted sutures were better healing compared with one row of horizontal mattress interrupted sutures patterns in goat. In dogs minimal intra-abdominal adhesions were seen macroscopically in end-to-end appositional by simple interrupted stitches with their knots tied intra luminal compared with end-to-end appositional by simple interrupted stitches tied extra luminal (Ali, 2011). On the others hand, Azevedo *et al.* (2008) reported that sero-submucosal stitches tied exterior over the serosa, had excellent realignment and regeneration of the layers

Adhesion formations were severely observed in SSIS group compared with SSCLS group. Degree of adhesion was influenced by the anastomosis technique and the time after surgery. Previous studies have shown that adhesions at an anastomosis can be caused by the contamination of the peritoneal area, sutures (foreign material), and ischemic changes of the intestine in the anastomotic region (DeCherney and DiZerega 1997; Ellis 1997 and Holmdahl *et al.*, 1997). Normal intestinal motility, combined with elaboration of collagenase during the maturation phase of wound healing, may be responsible for remodeling of the fibrous adhesions (Sullins *et al.*, 1985). Those results are in the same line with that obtained by other researchers, in horses, Al-Qadhi and Al-Hasan (2013) observed severe adhesions at anastomosis site with omentum when used apposition End-To-End jejunal anastomosis using simple interrupted suture pattern, Hanson *et al.* (1998b), revealed on post-mortem examination, extensive adhesion formations from the mesocolon to the stapled anastomotic site compared with the a simple interrupted suture pattern, although. Hanson *et al.* (1998a), reported that the adhesions formation were detected in horses when resection line was closed with the appositional one row suture pattern, Reinertson (1976), found that double rows inverting technique predisposed to intestinal obstruction was resulted in minimal adhesions in horses and ponies. Dean *et al.* (1985) reported that continuous inverting-suture pattern in the serosubmucosal layer resulted in significantly fewer adhesions than those underwent interrupted pattern.

Reinertson (1976) reported that, the modified Gambee technique for intestinal anastomosis resulted in minimal adhesions, and adequate strength, Alonso *et al.* (2014), observed that the incidence of postoperative adhesions with clinical manifestation in horses, in goats, it was found that one row of sero-submucosal interrupted sutures were better in healing compared with one row of horizontal mattress interrupted sutures patterns (Al-Timmemi *et al.*, 2010).

In dogs minimal intra-abdominal adhesions were seen macroscopically in end-to-end appositional intestinal anastomosis using simple interrupted stitches with their knots tied intra luminal compared with end-to-end appositional by simple interrupted stitches tied extra luminal (Ali, 2011). Hamza (2009) reported that biopsy examination revealed simple adhesions in the single layer by cross mattress interrupted suture patterns and single layer by cross mattress interrupted suture pattern covered by free omentum, however, no adhesions were observed in single layer by cross mattress interrupted suture patterns covered by pedicle omentum. On the others hand Azevedo *et al.* (2008) reported that sero-submucosal stitches tied exterior over the serosa, had excellent realignment and regeneration of the layers.

5. CONCLUSION

It could be concluded that both anastomotic suture patterns (SSCLS and SSIS) were effective, safe, and reliable and can be used in donkeys under field conditions, however, the SSCLS suture pattern was found to be superior to SSIS suture pattern.

Competing Interests

All authors have declared that there is no competing interests.

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